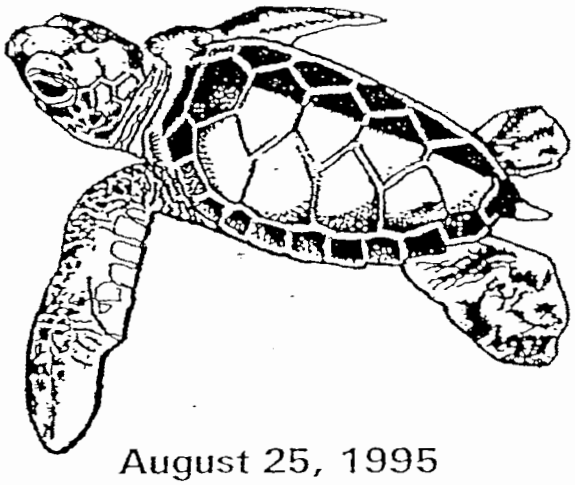
SUB-APPENDIX C-3

REGIONAL BIOLOGICAL OPINION
HOPPER DREDGING SOUTH ATLANTIC COAST

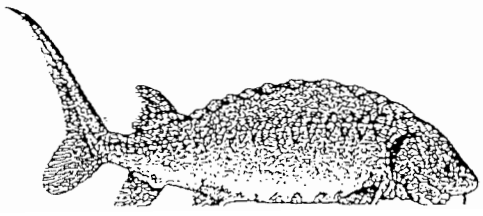
REGIONAL BIOLOGICAL OPINION
HOPPER DREDGING
SOUTH ATLANTIC COAST
(Excludes Canaveral, Florida)

INCLUDES SPECIFIC REQUIREMENTS AND RECOMMENDATIONS
FOR

Sea Turtles
Whales
Shortnose Sturgeon
and
Johnson's Seagrass



August 25, 1995
National Marine Fisheries Service



DEPARTMENT OF THE ARMY

CESAD-ET-PR (1105-2-10c) 25 August 1995

MEMORANDUM FOR

COMMANDER, CHARLESTON DISTRICT, ATTN: CESAC-EN-P
COMMANDER, JACKSONVILLE DISTRICT, ATTN: CESAJ-PD-E
COMMANDER, SAVANNAH DISTRICT, ATTN: CESAS-PD-E
COMMANDER, WILMINGTON DISTRICT, ATTN: CESAW-PD-E

SUBJECT: Regional Biological Opinion (RBO) for Hopper Dredging Along South Atlantic Coast

1. The signed version of the subject RBO is enclosed for your immediate use. We received this by fax today and have not yet evaluated all changes that have been made from earlier versions. A copy of an E-mail message from this office summarizing some of the changes is enclosed.

2. We will provide any necessary guidance on this RBO at a later date. Point of contact is Rudy Nyc, (404) 331-4619.

FOR THE DIRECTOR OF ENGINEERING AND TECHNICAL SERVICES:

Encl

FRANCIS X. McGOVERN
Acting Chief
Planning and Environmental Division
Directorate of Engineering and
Technical Services

BCF: Added
PD-ER (Dugger, Dupes, Fonferek, Boothby, Hammond, Traxler, Bozeman)
PD-EE (McAdams)
DP-I/A (Stevens, McMillan, Scarboro, Duke)
PD-PC (Schmidt)
PD-PN (Bailey)
OC (Brady)
CO-C (Adams)
CO-ON (Beasley)

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ceipt Requested
: John F Adams at sadhub
: Kenneth R Dugger at sadhub
: Mike Dupes at sadhub
: William C Long II at sadhub
: Paul Metz at sadhub
: Jim Preacher at sadhub
: Mark E Wolff at sadhub
: DENNIS BARNETT
: JOHN P DEVEAUX
: JAMES M KELLY
: GEORGE R PRINCE JR
: FRANK X MCGOVERN
bject: NMFS REGIONAL BIO. OPPINION ON HOPPER DREDGING

---------- Message Contents ----------

THE RBO WAS SIGNED TODAY (25 august 1995) BY WILLIAM W. FOX JR., DIRECTOR OF NMFS OFFICE OF PROTECTED RESOURCES IN WASHINGTON D.C.

WE HAVE MAILED A COPY OF THE SIGNED VERSION THAT WAS FAXED TO US TO YOUR OFFICE. WE WILL ALSO SEND YOU A COPY BY E-MAIL AS SOON AS WE GET IT FROM NMFS VIA INTERNET.

CHANGES THAT WERE MADE IN RBO BY NMFS WASHINGTON OFFICE ARE AS FOLLOWS:

* 100% MONITORING COVERAGE OF SCREENS FOR BEACH NOURISHMENT PROJECTS (THIS HAD BEEN 50% IN THE EARLIER VERSION OF THE RBO). THIS CHANGE WAS INSISTED ON BY NMFS HQ. LAWYERS.

* NUMBERS OF NMFS APPROVED OBSERVERS WAS DELETED FROM THE TABLE SHOWING DREDGING WINDOWS AND MONITORING REQUIREMENTS. THEIR RATIONAL FOR THIS CHANGE IS THAT THIS SHOULD BE A CORPS CALL RATHER THAN NMFS.

* MONITORING OF SCREENS DOES NOT HAVE TO BE PERFORMED FOR THE ENTIRE TIME THAT DREDGING IS UNDERWAY. WHAT THEY WONT IS THAT 100% OF THE MATERIAL IS SCREENED AND AN OBSERVER CHECKS THE SCREENS AFTER EACH DREDGING EVENT. FOR EXAMPLE, IF WE ARE DREDGING SAND THE OBSERVER NEEDS TO CHECK THE SCREEN AFTER THE DREDGING HAS STOPPED RATHER THAN SIT THERE AND OBSERVE THE SCREEN DURING DREDGING. NMFS WONTED TO GIVE US FLEXIBILITY IN MANAGING THIS PROGRAM.

* THE INCIDENTAL TAKE IN THIS RBO IS GOOD UNTIL 5 AUGUST 2000. THEIR LAWYERS WONTED AN ENDING DATE WHILE NMFS DID NOT WONT TO RENEW THE INCIDENTAL TAKE STATEMENT MORE FREQUENTLY THAN 5 YEARS.

* CONSULTATION MUST BE REINITIATED WHEN 75% IF THE AUTHORISED INCIDENTAL TAKE HAS BEEN REACHED. IN REALITY WE WOULD NEVER WAIT THAT LONG BEFORE RECONSULTING WITH THEM.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

Colonel James H. Simms, USA
Acting Commander
South Atlantic Division, Corps of Engineers
Room 313, 77 Forsyth St., S.W.
Atlanta, Georgia 30335-6801

AUG 25 1995

Dear Colonel Simms:

Enclosed is the biological opinion that concludes formal Endangered Species Act Section 7 consultation on hopper dredging of channels and beach nourishment activities in the southeastern United States from North Carolina through Florida East Coast. The National Marine Fisheries Service (NMFS) concurs with COE findings that dredging windows and further development of the rigid draghead deflector reduces the effects of hopper dredging on sea turtle species, while allowing dredging to continue. As you know, this consultation supersedes a previous regional opinion issued to the COE South Atlantic Division (SAD) on channel dredging in which NMFS found that continued hopper dredging activity in southeast channels along the Atlantic Coast was likely to jeopardize the continued existence of the Kemp's ridley sea turtle (November 25, 1991). The reasonable and prudent alternative issued with the 1991 opinion included the prohibition of hopper dredging in the Canaveral channel, seasonal restrictions which allowed hopper dredging from December through March in channels from North Carolina through Canaveral, or use of other dredges in all southeastern U.S. channels. Since the implementation of this alternative in the winter of 1991, only 14 takes of sea turtles, including three live turtles, have been documented on board hopper dredges in channels along the southeastern U.S. Atlantic Coast.

The Incidental Take Statement, reasonable and prudent measures, and conservation recommendations listed in the enclosed opinion have been discussed with the COE's SAD staff. Of note, hopper dredging windows are modified from the windows established in 1991 and observer requirements have been expanded to incorporate beach nourishment activities. The continued deployment of observers, and participation in the Right Whale Early Warning System, are also listed requirements within this biological opinion. Please note that the authorization for this incidental take expires August 5, 2000. In addition, consultation must be reinitiated when 75% of the authorized incidental take is reached.

Hopper dredging in Cape Canaveral, Florida is not considered under this consultation since turtle concentrations in Canaveral remain high year-round. Projects requiring the use of a hopper dredge in Canaveral will require further, project-specific, consultation.

Much of the new information considered in the enclosed opinion was the result of extensive research efforts recently concluded by COE in six southeast channels: Morehead City Harbor entrance channel, Charleston Harbor entrance channel, Savannah Harbor entrance channel, Brunswick Harbor entrance channel, Fernandina Harbor-St. Marys River entrance channel, and the Canaveral Harbor entrance channel. The results of this research support some modifications to previous seasonal restrictions for hopper dredging in these channels. Additionally, a draghead deflector has been developed that has shown promising results during preliminary tests and field application.

Through an extensive sea turtle research program and participation on the Right Whale Recovery Plan Implementation Team, the COE's SAD has become a leader among Federal action agencies in the southeast region in endangered species research and conservation. We look forward to continued cooperative efforts with your division.

Sincerely,

William W. Fox, Jr., Ph.D.
Director
Office of Protected Resources

Enclosure

cc: ACOE Charleston District, Col. George Hazel
Wilmington District, Col. Robert Sperperg
Savannah District, William Bailey
Jacksonville District, A. J. Salem
F/SEO13 - Oravetz

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

Endangered Species Act - Section 7 Consultation

Biological Opinion

Agency: U.S. Army Corps of Engineers, South Atlantic Division

Activity: Hopper dredging of channels and beach nourishment activities in the Southeastern United States from North Carolina through Florida East Coast

Consultation Conducted By: National Marine Fisheries Service, Southeast Regional Office

Date Issued: August 25, 1995

BACKGROUND

The U.S. Army Corps of Engineers (COE) has primary responsibility for maintaining navigational channels in U.S. waters. To accomplish this task, dredging is periodically required. A variety of dredge types and techniques are employed on a channel-specific basis, dependent upon the characteristics of channels, availability of disposal sites, local environmental regulations, types of material to be removed, proposed timing of the dredging, etc. In the southeastern United States, at least three types of dredges (hopper dredges, clamshell dredges, and pipeline dredges) are commonly used.

In addition, Congress has mandated that the COE provide periodic beach nourishment to certain beaches in the southeastern U.S. that suffer severe erosion rates. Nourishment activities consist of dredging coarse high-quality sand from offshore borrow areas then pumping the material onshore.

A formal consultation conducted on dredging and beach nourishment operations from North Carolina through Cape Canaveral, Florida, in 1991, and incorporated by reference, concluded that clamshell and pipeline dredges were not likely to adversely affect listed species. There is no new information to change the basis for

that finding. Lethal takes of sea turtles by hopper dredges have been documented, however, and consultations on takes have been conducted since 1980.

Previous Consultations

Consultation on the effects of hopper dredging in the Canaveral ship channel was initiated in August 1978, after NMFS trawl surveys verified reports of high turtle abundance in the channel. On March 30, 1979, NMFS issued a biological opinion based on a threshold examination of the situation. This opinion concluded that insufficient information existed to determine whether or not dredging was likely to jeopardize the continued existence of sea turtles. Through agreement with the COE and the U.S. Navy, trawl surveys were implemented to further assess turtle abundance and distribution in the channel.

On January 22, 1980, the National Marine Fisheries Service (NMFS) issued a biological opinion concluding that "dredging may result in the loss of large numbers of loggerhead sea turtles but is not likely to result in jeopardizing either the loggerhead or Atlantic ridley sea turtle stocks." This opinion recommended that NMFS-approved observers be placed aboard hopper dredges in the Canaveral channel to monitor turtle take, and that dredging be restricted to the period of August 1 through November 1. No evidence of turtle take by hopper dredges existed at this point, but the potential for take was recognized.

A total of 71 turtle takes by hopper dredges were documented in the Canaveral channel over the period of July 11 through November 13, 1980. These takes were considered minimum estimates of mortality due to restrictions inherent in observing turtles within the dredged material. From 1980 through 1986, NMFS, the COE, and the U.S. Navy continued efforts to reduce or eliminate turtle take by hopper dredges in the Canaveral entrance channel. Efforts included attempts to scare turtles out of the channel, detect and capture turtles, remove and relocate turtles, and deflect turtles from the draghead. No acceptable means of eliminating the take of sea turtles by hopper dredges was identified, and take of sea turtles continued.

Trawl surveys of five east coast channels, conducted during 1981 and 1982 (Butler et al., 1987), indicated that these channels did

not contain sea turtles at abundances approaching those observed in Canaveral. One or two turtles were collected in each of the surveyed channels, while hundreds were caught in the Canaveral channel. Because NMFS had no information to suggest that turtle takes in other channels was significant, additional channel surveys were not required, and the Canaveral hopper dredging project was treated as a unique problem.

In 1986, the U.S. Navy reinitiated Endangered Species Act (ESA) Section 7 consultation on Kings Bay, Georgia, channel dredging. The scope of the project involved widening and deepening existing channels and extension of the channel approximately 14 miles. The Navy proposed to implement sea turtle conservation measures including observer coverage, screening of the dredge, and a stand-by trawler to catch and remove turtles, if necessary. From July 1987 through December 1989, a total of 21 turtles were taken during hopper dredging operations in the Kings Bay project.

Turtle take by hopper dredges in Kings Bay resulted in major changes in NMFS policy on channel dredging. This was the first documented take of turtles by hopper dredges anywhere other than in the Canaveral channel. Additionally, while takes in Canaveral were confined to loggerhead turtles, Kings Bay takes included three endangered Kemp's ridley turtles and three endangered green turtles. NMFS began to consider the additive consequences of hopper dredging along the southeast coast.

The Jacksonville District COE and the COE Waterways Experiment Station jointly sponsored a May 11-12, 1988, "National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles," held in Jacksonville, Florida. This workshop brought together representatives of the COE, NMFS, the U.S. Navy, the dredging industry and the environmental community to discuss the dredging/sea turtle conflict. In a July 8, 1988, letter from the Assistant Administrator for Fisheries to the Acting Commander of the COE, NMFS applauded the COE efforts in sponsoring the workshop and advised the COE of agency plans to assess the cumulative impacts to sea turtles of dredging in channels other than Canaveral. Formal consultation was requested for all areas in which hopper dredging was proposed, and observers were required on 25-100 percent of all hopper dredging activities in Brunswick, Savannah, and Wilmington Harbor dredging projects.

Consultation was reinitiated in 1991 in response to the high levels of turtle takes observed, as well as nearby strandings of crushed turtles, during hopper dredging in Brunswick and Savannah channels. The biological opinion, issued November 25, 1991, found that continued unrestricted hopper dredging in channels along the southeast region's Atlantic coast could jeopardize the continued existence of listed sea turtles. A reasonable and prudent alternative was given which included the prohibition of hopper dredging in the Canaveral channel, seasonal restrictions which allowed hopper dredging from December through March in channels from North Carolina through Canaveral, or use of alternative dredges in all southeastern U.S. channels.

The reasonable and prudent alternative issued in the 1991 biological opinion has proven very effective in reducing sea turtle captures. Since the implementation of the measures of the 1991 biological opinion, only 14 takes of sea turtles, including three live turtles, have been documented on board hopper dredges in channels along the southeastern U.S. Atlantic coast.

The COE has recently concluded extensive research in six southeast channels: Morehead City Harbor entrance channel, Charleston Harbor entrance channel, Savannah Harbor entrance channel, Brunswick Harbor entrance channel, Fernandina Harbor - St. Marys River entrance channel, and the Canaveral Harbor entrance channel. Seasonal restrictions were supported by the research; however, refinements in the restrictions due to new, more precise information were requested in the COE request for a new consultation, dated November 8, 1994. Additionally, a draghead deflector has been developed that has shown promising results in preliminary tests.

PROPOSED ACTIVITY

This consultation addresses COE channel dredging activities along the southeastern Atlantic seaboard from North Carolina through Key West, Florida (see Figure 1 from COE's Biological Assessment submitted November 8, 1994). This includes maintenance dredging, new construction dredging, and beach nourishment activities. A summary of major channel dredging projects in which hopper dredges are normally used include: Oregon Inlet, Morehead City, and Wilmington Harbor in North Carolina; Charleston and Port

Royal in South Carolina; Savannah, Brunswick, and Fernandina-St. Marys in Georgia (King's Bay); Jacksonville, St. Augustine, Ponce Inlet, Canaveral, West Palm Beach, and Miami in Florida.

Information on the timing and amount of materials removed during past hopper dredging projects in these channels was provided in the Biological Assessment (COE, November 8, 1994). Generally, the COE has asked that channel hopper dredging windows specified in the 1991 biological opinion be modified from no hopper dredging in Canaveral and dredging in other regional channels from December through March to:

HOPPER DREDGING IN SOUTH ATLANTIC DIVISION		
LOCATION	HOPPER DREDGING WINDOW[1]	INCIDENTAL TAKE MONITORING[2]
North Carolina to Pawles Island, S.C.	Year Round	1 May - 1 Nov
Pawles Island, S.C. to Tybee Island, Ga.	1 Nov - 31 May	1 Nov - 1 Jan 1 Apr - 31 May
Tybee Island, Ga. to Titusville, Fla.	15 Dec - 1 May	15 Dec - 1 Jan 15 Mar - 1 May
Titusville, Fla. to Key West, Fla.	Year Round[3]	Year Round

1 Applies to all hopper dredging along South Atlantic Coast. Use of sea turtle deflecting draghead is required unless waiver is granted by CESAD.

2 For navigation projects this requires inflow screens and NMFS approved observers. For beach nourishment projects this can be accomplished by either monitoring the beach or use of observers and screens on the hopper dredge.

3 Use of hopper dredging at Canaveral Navigation Channel will be restricted to those times when there is an urgent need for this type of equipment.

During a meeting between the COE and NMFS in February 1995, it was determined that the impacts of beach nourishment activities along the southeastern U.S. Atlantic coast should also be considered in this biological opinion. Therefore, projects being considered in this consultation include those listed in the Biological Assessment submitted on November 8, 1994, as well as channels south of Canaveral, and beach nourishment activities along the southeastern U.S. Atlantic coast in which hopper dredges may be used. Specific projects which have been considered in ongoing consultations include: Palm Beach Harbor maintenance dredging; the Fort Pierce Harbor entrance channel and turning basin; and the Dade County Beach Erosion Control Project at the northern end of Sunny Isles.

LISTED SPECIES AND CRITICAL HABITAT

Listed species under the jurisdiction of the NMFS that may occur in channels along the southeastern United States and which may be affected by dredging include:

THREATENED:
(1) the threatened loggerhead turtle - Caretta caretta

ENDANGERED:
(1) the endangered right whale - Eubalaena glacialis
(2) the humpback whale - Megaptera novaeangliae
(3) the endangered/threatened green turtle - Chelonia mydas
(4) the endangered Kemp's ridley turtle - Lepidochelys kempii
(5) the endangered hawksbill turtle - Eretmochelys imbricata
(6) the endangered shortnose sturgeon - Acipenserbrevirostrum

Green turtles in U.S. waters are listed as threatened, except for the Florida breeding population which is listed as endangered.

Information on the biology and distribution of these species was given in the 1991 biological opinion, and is incorporated by reference. Channel-specific information has been collected by COE for channels at Morehead City, Charleston, Savannah, Brunswick, Fernandina and Canaveral, and is presented in detail in the COE summary report entitled "Assessment of Sea Turtle

Abundance in Six South Atlantic US Channels" (Dickerson et al., 1994) and in the COE Biological Assessment. New information is included below.

Additional endangered species which are known to occur along the Atlantic coast include the finback (Balaenoptera physalus), the sei (Balaenoptera borealis), and sperm (Physeter macrocephalus) whales and the leatherback sea turtle (Dermochelys coriacea). NMFS has determined that these species are unlikely to be adversely affected by hopper dredging activities.

PROPOSED, THREATENED:
(1) Johnson's seagrass - Halophila johnsonii

According to federal regulations (50 CFR Section 402.10), a conference is required if a planned federal action is likely to jeopardize the continued existence of a proposed species. At this time, NMFS is unable to make a determination on the collective effects of hopper dredging in and adjacent to channels in which Johnson's seagrass occurs. The COE should develop estimates of annual take of seagrass anticipated by projects within Florida's intracoastal waterways within Johnson's seagrass habitat. Consideration of impacts to H. johnsonii should continue on a project-by-project basis until collective impacts have been estimated and/or listing has been finalized.

ASSESSMENT OF IMPACTS

Sturgeon

Table 1, taken from the February 6, 1995 draft Shortnose Sturgeon Recovery Plan (NMFS, 1995), gives the current, best available information on the distribution and abundance of shortnose sturgeon. South of the Chesapeake Bay, there is inadequate information to estimate the shortnose sturgeon population size in most rivers. Low abundance estimates have been made for the Ogeechee and Altamaha rivers.

Generally in southern rivers, adult sturgeon remain in estuaries and at the interface of salt and freshwater until late winter, when they move upriver to spawn. Embryos produced tend to remain

in areas of irregular bottom, where they appear to seek cover. Juveniles, like adults, occur primarily at the interface between salt and freshwater. Recent observations suggest that salinity levels greater then seven ppt are harmful (Smith et al., 1992). In the Savannah River, shortnose sturgeon are found over sand/mud substrate in 10-14 m. depths (Hall et al., 1991). Spawning occurs in upstream channels of the Savannah, where the substrate consists of gravel, sand and logs (Hall et al., 1991). Shortnose sturgeon feed on crustaceans, insect larvae, and molluscs (NMFS, 1995).

Impacts of hopper dredging on sturgeon

NMFS believes that shortnose sturgeon may be adversely affected by hopper dredging within some channels and seasons. While endangered species observers on hopper dredges have documented the take of Atlantic sturgeon, no take of a shortnose sturgeon has been observed. Sturgeon may be encountered in channels north of Pawles Island, South Carolina, where dredging may be conducted year-round. Winter windows south of Pawles, however, will reduce the period in which shortnose sturgeon may be impinged. Adult sturgeon may occur in estuarine and tidal waters until February, when they migrate upstream to spawn. Salinity ranges favorable to adults and juveniles can exist in inner harbors during fall months. Use of the rigid draghead deflector developed to reduce the likelihood of incidental take of sea turtles by hopper dredges may also reduce the take of shortnose sturgeon. The impacts on small juveniles, larvae, and eggs, by other suction dredge types used upriver, will be considered on a case-by-case basis.

In addition to the possibility of a direct take of sturgeon, maintenance dredging by all dredge types has likely reduced foraging areas within dredged channels, since inter-dredging periods may be too brief to allow forage species to re-establish. Current primary foraging habitat is thought to occur outside of dredged channels.

Shortnose sturgeon are not likely to be affected by beach nourishment activities.

Sea Turtles

Precise data regarding the total number of sea turtles in waters of the southeastern U.S. Atlantic are not available. Trends in turtle populations are identified through monitoring of their most accessible life stages on the nesting beaches, where hatchling production and the number of nesting females can be directly measured. Figures 2 through 4 illustrate loggerhead, green and Kemp's ridley nesting trends at regularly monitored nesting beaches.

Index nesting beaches on which data collection methods and effort were standardized were established in Florida in 1989. Over 90 percent of all U.S. loggerhead nests occur in Florida, and over 80 percent of these are within indexed beaches (B. Schroeder, pers comm). During the six years monitored in this standardized manner, illustrated in Figure 2, loggerhead nesting appears to be stable. All green turtle nests in the United States occur in Florida, and most occur on index beaches. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the six years of regular monitoring (Figure 3).

The abundance of ridleys nests in Rancho Nuevo, Mexico, have been increasing since 1987 (Figure 4). Over 1500 nests were observed during the 1994 nesting season, representing the highest nesting year since monitoring was initiated in 1978. While these data need to be interpreted cautiously due to expanded monitoring efforts since 1990, up to 110,000 hatchlings were released from Rancho Nuevo during 1994, compared to 50,000 to 80,000 over the previous five to six years (Byles, pers comm).

Stranding data are generally believed to reflect the nearshore distribution of sea turtles (Figure 5). The use of turtle excluder devices (TEDs) in shrimp trawls is likely responsible for the sharp decrease in strandings after 1990 through a reduction in mortality resulting from incidental capture in shrimp trawls. While TEDs were required seasonally in most areas during much of 1990, compliance was poor until 1991. Since 1991, documented strandings of loggerheads were steady, while green turtle strandings increased in 1994 and ridleys in 1993 and 1994. Factors that may be affecting the distribution and abundance of sea turtles and turtle mortalities (ie. the distribution of

strandings) include: vessel activity, fishery operations, and environmental factors such as storms, temperature changes, and eutrophication events.

The data suggest that green and Kemp's ridley turtle populations may be rising. While this supports cautious optimism, the numbers are well below recovery criteria established in the recovery plans.

Impacts of hopper dredging on sea turtles

Channels

NMFS believes that hopper dredging activities in the southeastern United States may adversely affect the endangered Kemp's ridley and Florida green turtles and the threatened loggerhead turtle. While hawksbill turtles likely occur infrequently in ship channels, they may be present during beach nourishment activities in areas near or between hard-bottom reefs.

Past maintenance dredging in the southeastern United States has been demonstrated to adversely affect sea turtles. The biological opinion issued in 1991 in response to the high levels of turtle takes observed, as well as nearby strandings of crushed turtles during hopper dredging in Brunswick and Savannah channels, concluded that continued unrestricted hopper dredging in channels along the southeast region's Atlantic coast could jeopardize the continued existence of listed sea turtles. Takes of 225 sea turtles had been documented since 1980 in southeast channels, including 22 turtles that were alive when found. The COE's strict adherence to the measures included in the 1991 biological opinion, including a prohibition of hopper dredging in Canaveral and seasonal restrictions on hopper dredging from North Carolina through the Canaveral ship channel, has greatly reduced the rate of sea turtle takes by hopper dredges. Only 14 sea turtle takes have been documented in hopper dredges since 1991, including three turtles that were alive when collected.

The COE conducted a comprehensive research program, beginning in 1991, to investigate the occurrence of sea turtles in six southeast channels to determine seasonal abundance, as well as spatial distribution within the channel and within the water column. Monthly surveys were conducted in Canaveral, Kings Bay, Brunswick, Savannah, Charleston, and Morehead City channels. The

Canaveral surveys supplement surveys conducted by NMFS and the COE since 1978.

Briefly, the surveys found the following: In areas where sea turtles occur, moderate to high abundance can be expected when water temperature is greater than or equal to 21 degrees C. Lower abundances were observed when temperatures were less than 16 degrees C. Other workers have observed sea turtles in waters as low as 8 degrees C, sometimes for extended periods (Morreale, pers comm 1993). Loggerheads, primarily adults, were the most abundant turtle captured (n = 645), although some Kemp's ridleys (n = 20) and green turtles (n = 5) were also taken. Juveniles of all species were observed, although only a few juvenile loggerheads were encountered in Canaveral. As documented in previous surveys, the Canaveral ship channel supports aggregations of sea turtles during all months of the year and, particularly during cooler winter months (Henwood, 1987; Butler et al., 1987; Henwood and Ogren, 1987). North of Canaveral, turtles were seasonally abundant, with lower numbers from December through February. Recaptures of relocated sea turtles suggest some site fidelity, and the effectiveness of relocation efforts appeared to be related to the distance of relocation. Catch per unit effort (CPUE) in the surveyed channels, for all seasons cumulatively, was: Canaveral, 1.43 turtles per hour; Kings Bay, 0.571 turtles per hour; Brunswick Harbor, 0.489 turtles per hour; Charleston Harbor, 0.206 turtles per hour; and Morehead City Harbor, 0.025 turtles per hour.

As a result of observed CPUE, which were generally lower during cool water periods in the northern channels, the COE has asked NMFS to relax dredging windows to allow year-round dredging north of Pawles Island, South Carolina (which includes the ship channels at Oregon Inlet, Morehead City and Wilmington), and between November and May 31 from Tybee Island, Georgia through Pawles Island (including Charleston, Port Royal and Savannah channels). In recent years, the COE SAD has shown a willingness to cease dredging in channels in which take rates exceed those anticipated, despite the fact that the incidental take level was not approached. Given the COE's conservative record in these channels, and the great reduction in takes observed under current dredging windows, NMFS concurs that some expansion of hopper dredging windows, with requirements for observers and use of the rigid draghead deflector, may result in sea turtle takes, but is

not likely to jeopardize the continued existence of any sea turtle species.

Beach Nourishment Activities

There has been increasing concern regarding the effects of hopper dredging during beach nourishment activities along the southeastern U.S. coast. Anecdotal accounts from divers and biologists suggest that sea turtles may use offshore fine sediment bottoms, as well as areas adjacent to hard bottom reefs, as internesting habitat. Limited observations have noted that at times of extreme drops in temperature, turtles have been observed buried in fine silt covering area reefs, either after beach nourishment or extreme freshwater runoff. Over 174 sea turtles have been observed on the sea surface during 16 right whale aerial surveys conducted between February 27 and March 19, 1995 along line transects within approximately 10 nm of the borrow area off of Jacksonville, Florida, suggesting an abundance of sea turtles in the vicinity of the borrow area. These turtles may be taken by hopper dredges. There has been no documented take of sea turtles during past beach nourishment activities at the borrow areas. However, due to potential impact, one hundred percent observer coverage is necessary for beach nourishment activities during the periods identified on the table. This observer coverage may be subsequently altered upon authorization from NMFS.

NMFS remains concerned that nearshore reefs, which provide foraging habitat and shelter for sea turtles, can be impacted by turbidity caused by dredging. While hopper dredges produce less turbidity than other dredge types, water quality impacts are still likely. State monitoring requirements do not relate directly to light restrictions caused by dredging, which has been shown to impact these ecosystems. Direct mechanical damage to hard bottom reefs, which may also be important turtle habitats, has also been documented (Draft Environmental Assessment prepared for the Second Periodic Nourishment of the Sunny Islands and Miami Beach Segments, Beach Erosion Control and Hurricane Protection Project, Dade County, Florida, January, 1995). The COE has proposed 1:1 mitigation of hard bottom habitat; however, replacement of biological material lost cannot be mitigated. Preventative steps should be identified within dredging contracts for borrow areas near hard-bottom reefs.

Rigid Draghead Deflector

Included within the COE's comprehensive research program, initiated in 1991, was a program to develop a mechanical solution to reduce the take of sea turtles at the dredge draghead. The COE SAD and the Waterways Experiment Station (WES) developed a rigid deflector for attachment to the draghead. This rigid draghead deflector has shown promising results during preliminary tests. The rigid device, similar in principal to the cow catchers developed for trains, is designed to deflect sea turtles encountered during hopper dredging activities. When deployed with mock turtles, the deflector draghead effectively avoided taking 95 percent of the models. According to the terms and conditions of the Incidental Take Statement issued for the 1991 biological opinion, testing of the effectiveness of the rigid deflector draghead in a channel where sea turtles occur present was necessary. NMFS recommended that the COE evaluate the new draghead in September in the Canaveral shipping channel, when juvenile turtles are present, but adults and gravid females are scarce. A supplementary biological opinion regarding the impacts of dredging using the deflector draghead in the Cape Canaveral channel for up to 15 days between September 14 and October 14, 1994 was issued in September 1994.

Although trawl sampling indicates that sea turtles were present in Canaveral at levels observed in previous years, only one sea turtle, a live green turtle, was observed entrained by the dredge. Twenty-one surface sightings of sea turtles were made in the channel, transit area, and at the disposal site. These results supported the mock turtle trials. However, despite the use of the rigid draghead deflector, two green turtle entrainments were documented in the Palm Beach Harbor entrance channel. Takes by a hopper dredge equipped with the deflector were also documented in Brazos Pass, in the Gulf of Mexico. NMFS believes that instruction of private dredge contractors is necessary to improve the performance of the rigid deflector draghead. Additionally, the effectiveness of the draghead may be dependent on the ability of the dredge operator to keep the dredging pumps disengaged when the dragheads are not firmly on the bottom to prevent impingement of sea turtles within the water column. Lastly, flexibility at the draghead is reportedly needed to improve the performance and ease of operation of this mechanical device. Additional assessment and development appears to be needed before the rigid draghead deflector can replace

seasonal restrictions as a method of reducing sea turtle captures during hopper dredging activities.

Whales

Right whale

The nearshore waters of northeast Florida and southern Georgia were formally designated as critical habitat for right whales on June 3, 1994 (28793). These waters were first identified as a likely calving and nursery area for right whales in 1984. Since that time, Kraus et al. (1993) have documented the occurrence of 74 percent of all the known mature females from the North Atlantic population in this area. While sightings off Georgia and Florida include primarily adult females and calves, juveniles have also been observed.

Twenty percent of all right whale mortalities observed between 1970 and 1989 were caused by vessel collisions/interactions with right whales. Seven percent of the population exhibit scars indicative of additional, non-lethal vessel interactions (Kraus, 1990). As a result of the potential for interactions between hopper dredges and right whales, the 1991 biological opinion required observers on board dredges operating from December through March in Georgia and northern Florida to maintain surveys for the occurrence of right whales during transit between channels and disposal areas. Continuation of aerial surveys, which had been instituted in Kings Bay, Georgia, was also required. Since January 1994, aerial surveys funded by the COE in association with dredge activities in the southeast have been amplified through the implementation of the right whale early warning surveys. These surveys, funded by COE, as well as the Navy and Coast Guard, are conducted to identify the occurrence and distribution of right whales in the vicinity of ship channels in the winter breeding area, and to notify nearby vessel operators of whales in their path. The COE has been instrumental in NMFS' communications with other federal action agencies regarding the importance of pro-active protection of right whales through a cooperative recovery plan implementation team.

Whales observed on aerial and shipboard surveys are individually identified and counted, cow/calf pairs are recorded, and the movements and distribution of the whales are noted. Dredge speeds are reduced to five knots or less during evening hours or

periods of low visibility for 24 hours after sightings of right whales within 10 nm of the channel or disposal areas.

Data collected during these surveys suggest that right whales are observed off Savannah, Georgia, in December and March, and are relatively abundant between Brunswick, Georgia, south to Cape Canaveral from December through March. During early 1995, a right whale was also observed by shipboard observers off Morehead City, North Carolina (1/10/95, probable right whale).

Humpback whale

Humpback whales occur in waters under U.S. jurisdiction throughout the year. Migrations occur annually between their summer and winter ranges. The summer range for the Western North Atlantic stock includes the Gulf of Maine, Canadian Maritimes, western Greenland, and the Denmark Strait. All humpback whales feed while on the summer range.

The primary winter range includes the Lesser Antilles, the Virgin Islands, Puerto Rico, and the Dominican Republic (NMFS, 1991). In general, it is believed that calving and copulation take place on the winter range. Calves are born from December through March and are about 4 meters at birth. Sexually mature females give birth approximately every two to three years. Sexual maturity is reached between 4 and 6 years of age for females and between 7 and 15 years of age for males. Size at maturity is about 12 meters.

Until recently, humpback whales in the mid- and south Atlantic were considered transients. Few were seen during aerial surveys conducted over a decade ago (Shoop et al., 1982). However, since 1989, sightings of feeding juvenile humpbacks have increased along the coast of Virginia and North Carolina, peaking during the months of January through March in 1991 and 1992 (Swingle et al., 1993). Studies conducted by the Virginia Marine Science Museum (VMSM) indicate that these whales are feeding on, among other things, bay anchovies and menhaden. Researchers theorize that juvenile humpback whales, which are unconstrained by breeding requirements that result in the migration of adults to relatively barren Caribbean waters, may be establishing a winter foraging area in the mid-Atlantic (Mayo, pers comm, 1993). The lack of sightings south of the VMSM study area is a function of

shipboard sighting effort, which was restricted to waters surrounding Virginia Beach, Virginia.

In concert with the increase in whale sightings, strandings of humpback whales have increased between New Jersey and Florida since 1985. Strandings were most frequent during the months of September through April in North Carolina and Virginia waters, and were composed primarily of juvenile humpback whales of no more then 11 meters in length (Wiley et al., 1995). Of the 18 humpbacks for which the cause of mortality was determined, 6 (33 percent) were killed by vessel strikes. An additional humpback had scars and bone fractures indicative of a previous vessel strike that may have contributed to its mortality.

Shipboard observations conducted during daylight hours during dredging activities in the Morehead City Harbor entrance channel during January and February 1995 documented sightings of young humpback whales on at least six days near the channel and disposal area, until the last sighting on January 22, 1995. Three humpback strandings were documented in North Carolina, one each in February, March, and April, suggesting that humpback whales remained within waters of the South Atlantic Division through April.

Impacts of hopper dredging on whales

Hopper dredging may adversely affect right and humpback whales, which occur during winter months in the vicinity of dredging projects within the SAD. While dredging itself is not likely to be a problem, the transit of hopper dredges between borrow, channel, and disposal areas is likely to result in increased vessel traffic in the vicinity of humpback and right whales, especially within right whale critical habitat. As discussed above, ship strikes are one of the primary human-caused sources of mortality for both humpback and right whales, and increased vessel traffic may increase the likelihood of whale/vessel interactions. Although whales have been observed in areas of dredge operations, as discussed below, there have been no documented collisions between dredges and whales.

Observers on dredges have documented close approaches between whales and dredges. On February 6, 1988, a right whale reacted to the approach of a hopper dredge within 100 yards by orienting

itself toward the vessel in a defensive profile. On February 28, 1988, during clamshell dredging of Canaveral channel, a right whale remained in the Canaveral channel for a period of about 10 minutes. Fortunately, this took place during daylight hours and when no vessels were transiting the channel. On January 12, 1995, a humpback whale was observed within a quarter of a mile of the dredge at Wilmington channel and resurfaced near the dredge. An approaching humpback on January 13, 1995 was observed ahead of the dredge initially, but resurfaced near the stern after the vessel slowed. Dredging was stopped while the whale, and two other humpbacks nearby, approached within 100 yards, including one passage under the bow. On January 18, still within the Wilmington Harbor channel dredging area, one of a few humpbacks observed feeding surfaced and quickly dove again within 10 meters of the dredge.

NMFS believes that the cooperation of the dredge operators with endangered species observers greatly reduces the chance of whale/dredge interactions. Additional precautions that reduce the likelihood of dredge collisions with endangered whales include: aerial surveys conducted in right whale critical habitat during the breeding season, the adoption by dredge operators of necessary precautions when whales are sighted, and reduction in dredge speed during evening hours or days of limited visibility when whales have been spotted within the previous 24 hours.

CONCLUSIONS

NMFS concludes that endangered and threatened sea turtles, including the threatened loggerhead (Caretta caretta), and endangered Kemp's ridley (Lepidochelys kempii), green (Chelonia mydas) and hawksbill (Eretmochelys imbricata) sea turtles, may be adversely affected by hopper dredging of channels and during beach nourishment activities along the U.S. southeast Atlantic coast, but are not likely to be jeopardized under the terms and conditions of the attached Incidental Take Statement. Shortnose sturgeon (Acipenser brevirostrum) may be adversely affected by hopper dredging of channels, but are not likely to be jeopardized in rivers of the Southeast Region. Right whales (Eubalaena glacialis) and humpbacks (Megaptera novaengliae) also may be adversely affected due to increased vessel traffic, but severe

impacts can be avoided through continued cooperation between dredge operators and endangered species observers during the seasons whales may occur in the project area.

CONSERVATION RECOMMENDATIONS

Pursuant to section 7(a)(1) of the ESA, the following conservation recommendations are made to assist the COE in reducing/eliminating adverse impacts to loggerhead, green, and Kemp's ridley turtles that result from hopper dredging in the southeastern United States. Many of these recommendations have been discussed and agreed upon at the recent COE/NMFS meeting in St. Petersburg, Florida.

1. The COE should continue to investigate possible modifications to existing dredges which might reduce or eliminate the take of sea turtles. The effectiveness of the rigid draghead deflectors should continue to be evaluated.

2. Spring and fall surveys are necessary in the Canaveral shipping channel to identify sea turtle temporal and spatial movement patterns if hopper dredging will be needed regularly for the Canaveral channel in the future. Telemetry using depth recorders may be needed to obtain information on water column use.

3. Spatial distribution of sea turtles taken in COE trawl surveys of southeast ship channels appeared to be non-random. Additional investigation into the characteristics of "preferred" sites may provide information to expand dredging windows in channel areas adjacent to these areas of greater abundance.

4. The COE should provide NMFS with a list of inshore and offshore borrow areas along the southeastern U.S. Atlantic in which hopper dredges are likely to be used. Frequency of anticipated beach nourishment activities should be identified as accurately as possible.

5. The COE should summarize information regarding borrow areas in which hopper dredges may be deployed. Information regarding the biological resources found at each borrow area

should be listed to identify the possible suitability of the area for foraging sea turtles.

6. The COE should evaluate the collective impact of all dredging projects within the Florida intracoastal waterways on Johnson's seagrass. A summary of anticipated projects and estimates of annual seagrass take levels should be developed to allow NMFS to provide a comprehensive conference or consultation.

7. NMFS, based on the recommendations of Griffen (1974), has recommended water column sediment load deposition rates of no more then 200 mg/cm^2/day, averaged over a seven day period to protect coral reefs and hard bottom communities, rather than use of only state standards.

INCIDENTAL TAKE STATEMENT

Section 7(b)(4) of the Endangered Species Act (ESA) requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA, and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such impacts. Only incidental taking resulting from the agency action, including incidental takings caused by activities approved by the agency, that are identified in this statement and that comply with the specified reasonable and prudent measures, and terms and conditions, are exempt from the takings prohibition of section 9(a), pursuant to section 7 of the ESA.

Based on results of previous hopper dredging activities in southeastern U.S. channels, new information regarding Kemp's ridley and green sea turtle abundance, and expanded dredging windows and appended monitoring of beach nourishment activities in the South Atlantic Division, NMFS anticipates that future hopper dredging activities may result in the injury or mortality of loggerhead, Kemp's ridley, green, and hawksbill turtles. Therefore, a low level of incidental take, and terms and conditions necessary to minimize and monitor takes, is established. The documented incidental take, by injury or mortality, of seven (7) Kemp's ridleys, seven (7) green turtles, two (2) hawksbills, twenty (20) loggerhead turtles, and five (5) shortnose sturgeon is set pursuant to section 7(b)(4) of the ESA. This take level represents the total authorized take per year for hopper dredging in the Atlantic projects of the South Atlantic Division (SAD).

To ensure that the specified levels of take are not exceeded early in any project, the COE should reinitiate consultation for any project in which more than one turtle is taken in any day, or once five or more turtles are taken. The Southeast Region, NMFS, will cooperate with the COE in the review of such incidents to determine the need for developing further mitigation measures or to terminate the remaining dredging activity. Formal consultation must be reinitiated when 75% of the authorized incidental take is reached. The authorization for these incidental takes expires on August 31, 2000.

Section 7(b)(4)(c) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under section 101(a)(5) of the Marine Mammal Protection Act of 1972 (MMPA). Since no incidental take in the Atlantic Region has been authorized under section 101(a)(5) of the MMPA, no statement on incidental take of listed right whales is provided.

The reasonable and prudent measures that NMFS believes are necessary to minimize the impact of hopper dredging in the southeastern United States have been discussed with the COE. The following terms and conditions are established to implement these measures and to document the incidental take should such take occur. It is anticipated that beach nourishment will not occur year-round, due to environmental protections instituted by other agencies.

1. Regular maintenance activity in Canaveral Harbor shall not be conducted with a hopper dredge. A hopper dredge should be considered only under emergency conditions when no other type of dredge can be used to remove hazardous shoaling in an expedited timeframe. Separate, specific Section 7 consultations must be conducted for all dredging activities in the Canaveral ship channel that may require the use of a hopper dredge. These consultations will be accelerated if warranted by emergency conditions.

2. One hundred percent inflow screening is required, and 100 percent overflow screening is recommended when sea turtle observers are required on hopper dredges in areas and seasons in which sea turtles may be present (see table below). If conditions disallow 100 percent inflow screening, inflow screening can be reduced but 100 percent overflow screening is required, and an explanation must be included in the preliminary dredging report (see 6, below).

3. The sea turtle deflecting draghead is required for all hopper dredging during the months that turtles may be present, unless a waiver is granted by the COE SAD in consultation with NMFS.

4. Beach observers cannot be used in place of shipboard observers for hopper dredging of borrow areas unless the COE

can demonstrate that the volume of sand deposited on beaches will not preclude observation and identification of turtles or turtle parts.

5. To prevent impingement of sea turtles within the water column, every effort should be made to keep the dredge pumps disengaged when the dragheads are not firmly on the bottom.

6. Reporting: A preliminary report summarizing the results of the dredging and the sea turtle take must be submitted to the COE and NMFS within 30 working days of completion of any given dredging project. An annual report (based on either calendar or fiscal year) must be submitted to NMFS summarizing hopper dredging projects, documented sea turtle and sturgeon incidental takes, and whale sightings.

7. The COE's continued participation in the Right Whale Early Warning System is necessary. Dredging within right whale critical habitat from December through March must follow the protocol established within the Early Warning System.

8. NMFS requires monitoring by endangered species observers with at-sea large whale identification experience to conduct daytime observations for whales between December 1 and March 31, when humpback and right whales occur in the vicinity of channels and borrow areas, north of Cape Canaveral. Monitoring will be 100% for the first year of the biological opinion, unless subsequently altered upon authorization from NMFS. During daylight hours, the dredge operator must take necessary precautions to avoid whales. During evening hours or when there is limited visibility due to fog or sea states of greater than Beaufort 3, the dredge must slow down to 5 knots or less when transitting between areas if whales have been spotted within 15 nm of the vessel's path within the previous 24 hours. South of Cape Canaveral, surveys for whales should be conducted by endangered species observers during the intervals between dredge spoil monitoring.

9. The seasonal observer requirements under these terms and conditions are listed on the following table. North of the St. Johns River, in Florida, endangered species observers on hopper dredges within nearshore and riverine areas must also monitor for shortnose sturgeon impingements.

RESTRICTIONS D MONITORING REQUIREMENTS FOR HOPPER DREDGING ACTIVITIES IN THE ATLANTIC WATERS OF THE COE SOUTH ATLANTIC DIVISION

AREA	WHALE MONITORING for beach nourishment, navigation channels, and transit	SEA TURTLE MONITORING: NAVIGATION CHANNELS		SEA TURTLE MONITORING: BEACH NOURISHMENT ACTIVITIES	
		WINDOWS	MONITORING	WINDOWS	MONITORING[1]
North Carolina to Pawles Island, SC (includes channels at Oregon Inlet, Morehead City and Wilmington)	100% dedicated daytime whale observer coverage between 1 Dec and 31 Mar. Monitoring by sea turtle observer between 1 Apr and 30 Nov.	Year Round	100% observer monitoring from 1 Apr - 30 Nov	Year Round	100% observer monitoring from 1 Apr - 30 Nov
Pawles Island, SC to Tybee Island, GA (includes channels at Charleston, Port Royal and Savannah)	100% dedicated daytime whale observer coverage between 1 Dec and 31 Mar. Monitoring by sea turtle observer between 1 Apr - 30 Nov.	1 Nov - 31 May	100% observer monitoring from 1 Nov - 30 Nov and 1 Apr - 31 May	Year Round	100% observer monitoring from 1 Apr - 30 Nov
Tybee Island, GA to Titusville, FL (includes channels at Brunswick, Kings Bay, Jacksonville, St. Augustine, and Ponce de Leon Inlet)	Aerial surveys in right whale critical habitat, 1 Dec thru 31 Mar. 100% dedicated daytime whale observer coverage between 1 Dec and 31 Mar.	1 Dec - 15 Apr	100% observer monitoring from 1 Apr - 15 Apr	Year Round	100% observer monitoring from 1 Apr - 15 Dec
Titusville, FL to Key West, FL (includes channels at West Palm Beach, Miami and Key West)	Whale observations are not necessary beyond those conducted between monitoring of dredge spoil.	Year Round	100% observer monitoring year round	Year Round	100% observer monitoring year round

[1] 100% of the dredge material must be screened and 100% of the screened material must be observed.

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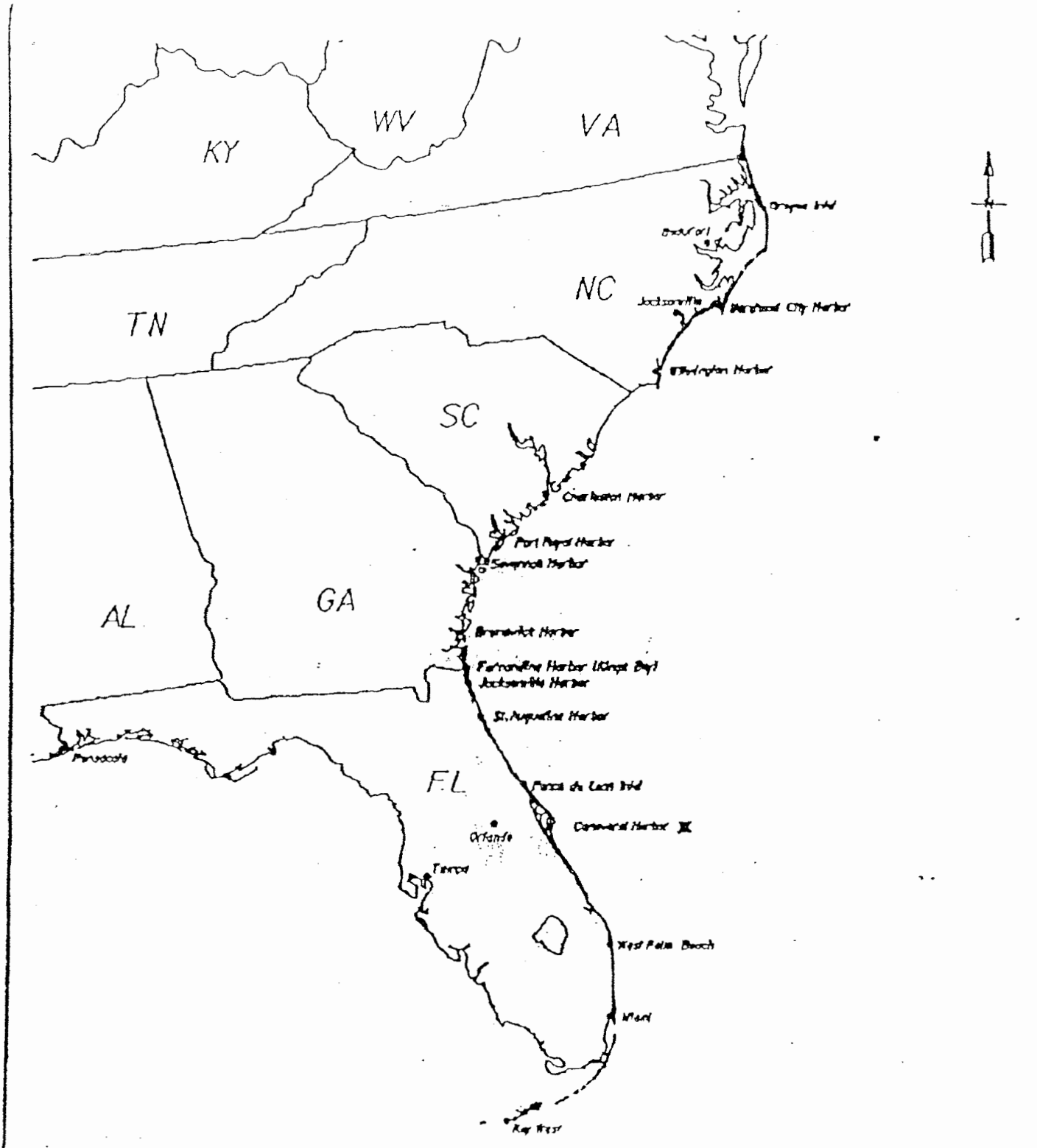
Table 1 Shortnose Sturgeon Population Estimates.

Locality	Time Segment	Population Segment	Marked m	Captured c	Recaptured r	Estimate Type	Population Estimate	Precision 95% CI		m/4N	Source and Notes
St. John	1973-77	Adult	3,705	4,082	343	S-J	18,000	±30%		>1	Dadswell (1979)
Kennebec	1977-81	Adult	675	272	34	PET	5,273	3,632	6,914	8.7	Squiers et al. (1982)
	1977-81	Adult	703	272	56	SCH	7,222	5,046	10,765		Squiers et al (1982)
Merrimack	1989	Spawning, males				CAP	5	5	20		Kynard (unpublished data)
	1988-90	Spawning, males				CAP	12	10	28		Kynard (unpublished data)
	1989-90	Total				CAP	33	18	89		Kynard (unpublished data)
Connecticut											
Upper	1992	Spawning				CAP	47	33	80		Kynard (unpublished data)
	1993	Spawning				CAP	98	58	231		Kynard (unpublished data)
	1976-77	Total	51	162	16	PET	516	317	898	>1	Taubert (1980)
	1976-78	Total	51	56	4	PET	714	280	2,856	>1	Taubert (1980)
	1977-78	Total	119	56	18	PET	370	235	623	>1	Taubert (1980)
	1976-78	Total	170	56	24	PET	297	267	618	>1	Taubert (1980)
Lower		Total				SHU	895	799	1,018		Savoy and Shake (1993)
		Total				SCH	875				
		Total				CHA	856				
Hudson	1979	Spawning	548	899	38	PET	12,669			>1	Dovel (1981)
	1980	Spawning	811	898	40	PET	13,844			>1	Dovel (1981)
	1980	Total					30,311				Dovel (1981), extrapolation
Delaware	1981-84	Partial				PET	14,080	10,079	20,378		Hastings et al. (1987)
	1981-84	Partial				SCH	12,796	10,288	18,267		Hastings et al. (1987)
	1983	Partial				S-J	6,408				Hastings et al. (1987)
Ogeechee	1993	Total	31	36	5	PET	223				Rogers and Webber (1993)
Altamaha	1991	Total	551			SPET	3,250				Rogers (unpublished data)

Estimates Type:
S-J: Seber Jolly
PET: Modified Peterson
SCH: Modified Schnabel
CAP:CAPTURE Methodology
SHU: Schumacher
CHA:Chapman
SPET:Simple Peterson



LOCATION OF SOUTHEASTERN HARBOR PROJECTS IN WHICH HOPPER DREDGES ARE USED

X NOTE: HOPPER DREDGING IN CANAVERAL HARBOR WAS SUSPENDED IN 1991.

FIGURE 1

FLORIDA INDEX NESTING BEACH SURVEYS

Caretta caretta

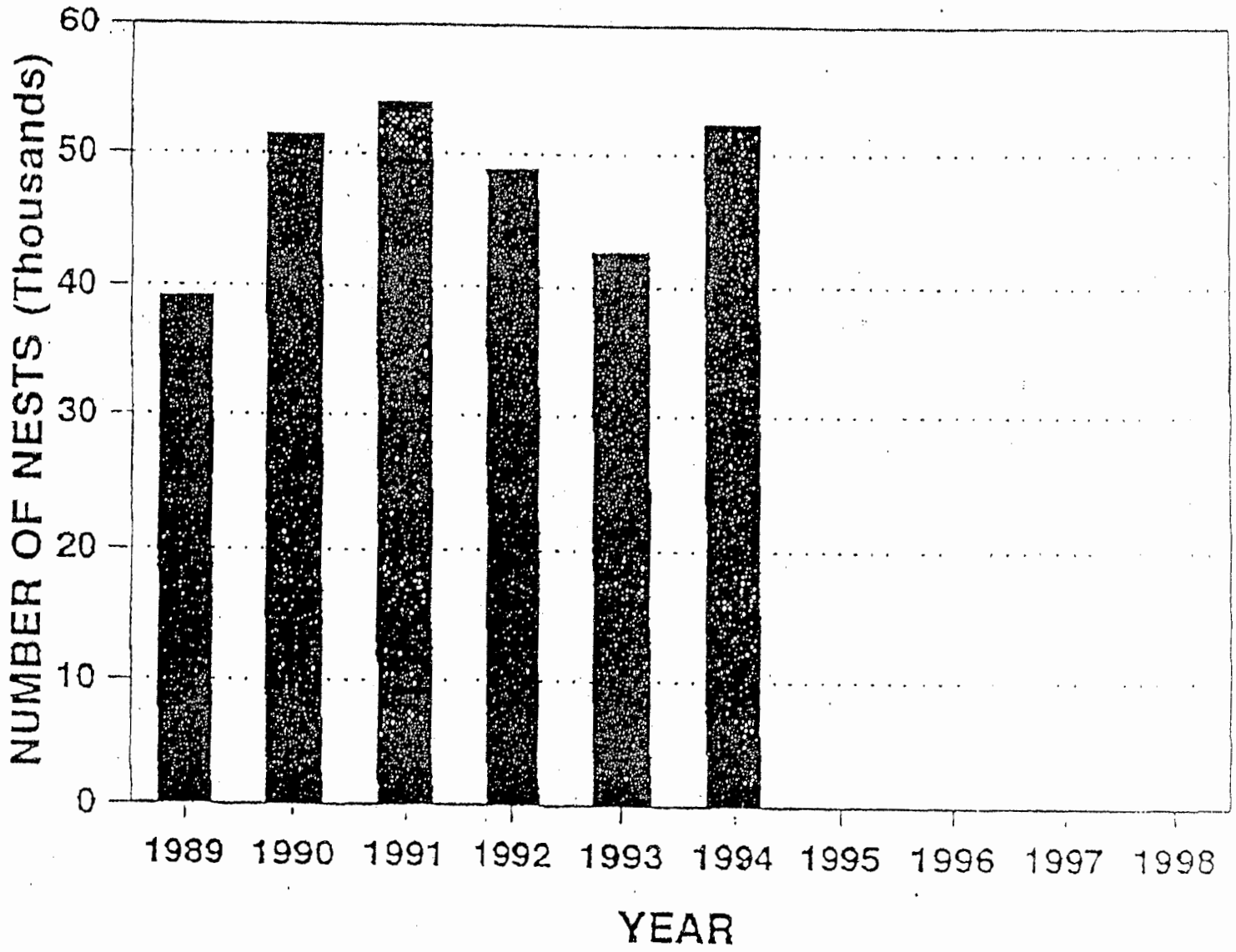


FIGURE 3

FLORIDA INDEX NESTING BEACH SURVEYS

Chelonia mydas

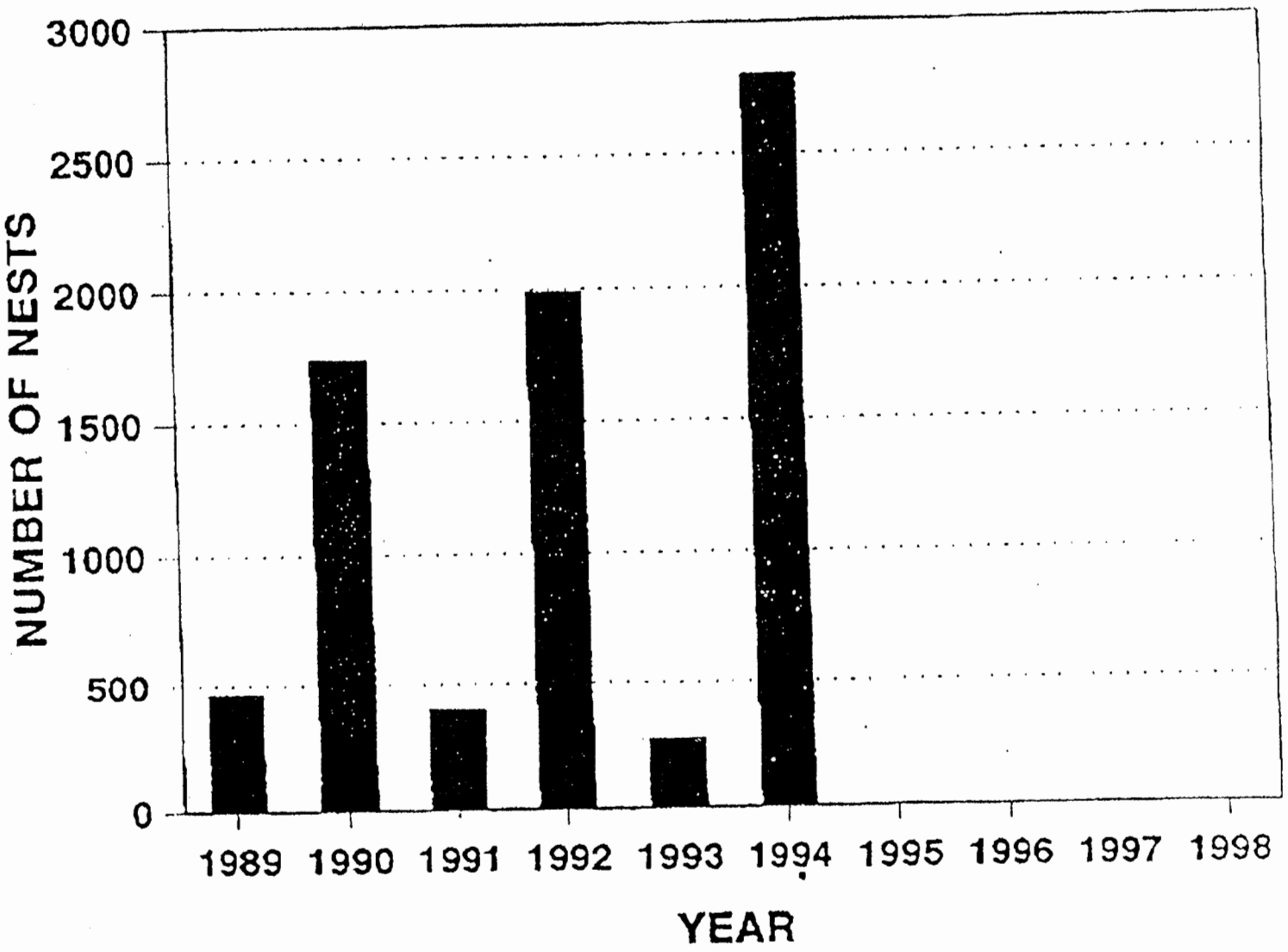
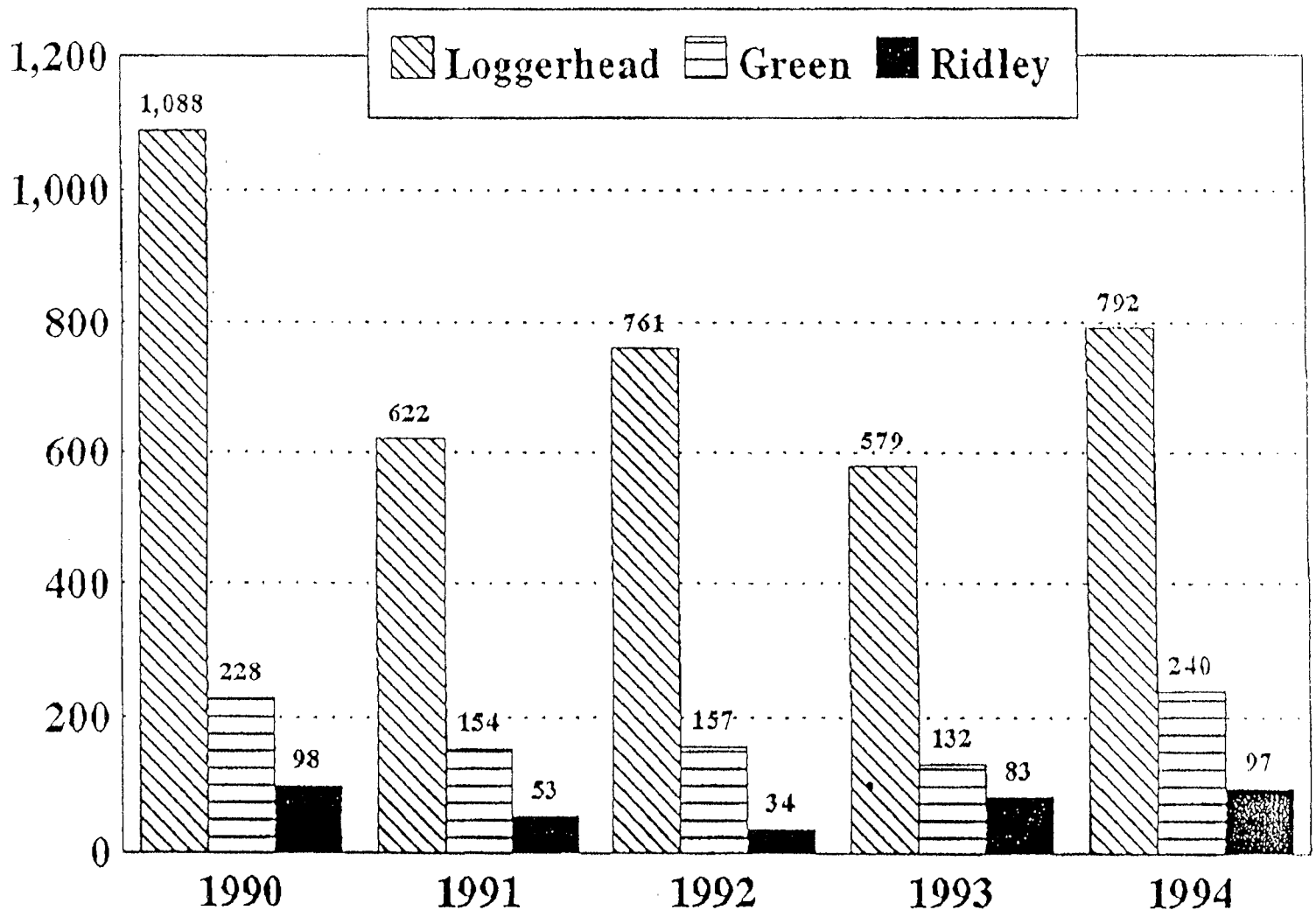


Figure 5

Southeast U.S. Atlantic Coast

Sea Turtle Strandings, 1990 - 1995



KEMP'S RIDLEY NESTS AT RANCHO NUEVO

FWS/INP DATA 1978-1994 (R BYLES 12/94)